HID 362
MESLEKİ İNGİLİZCE 2

Hafta 9

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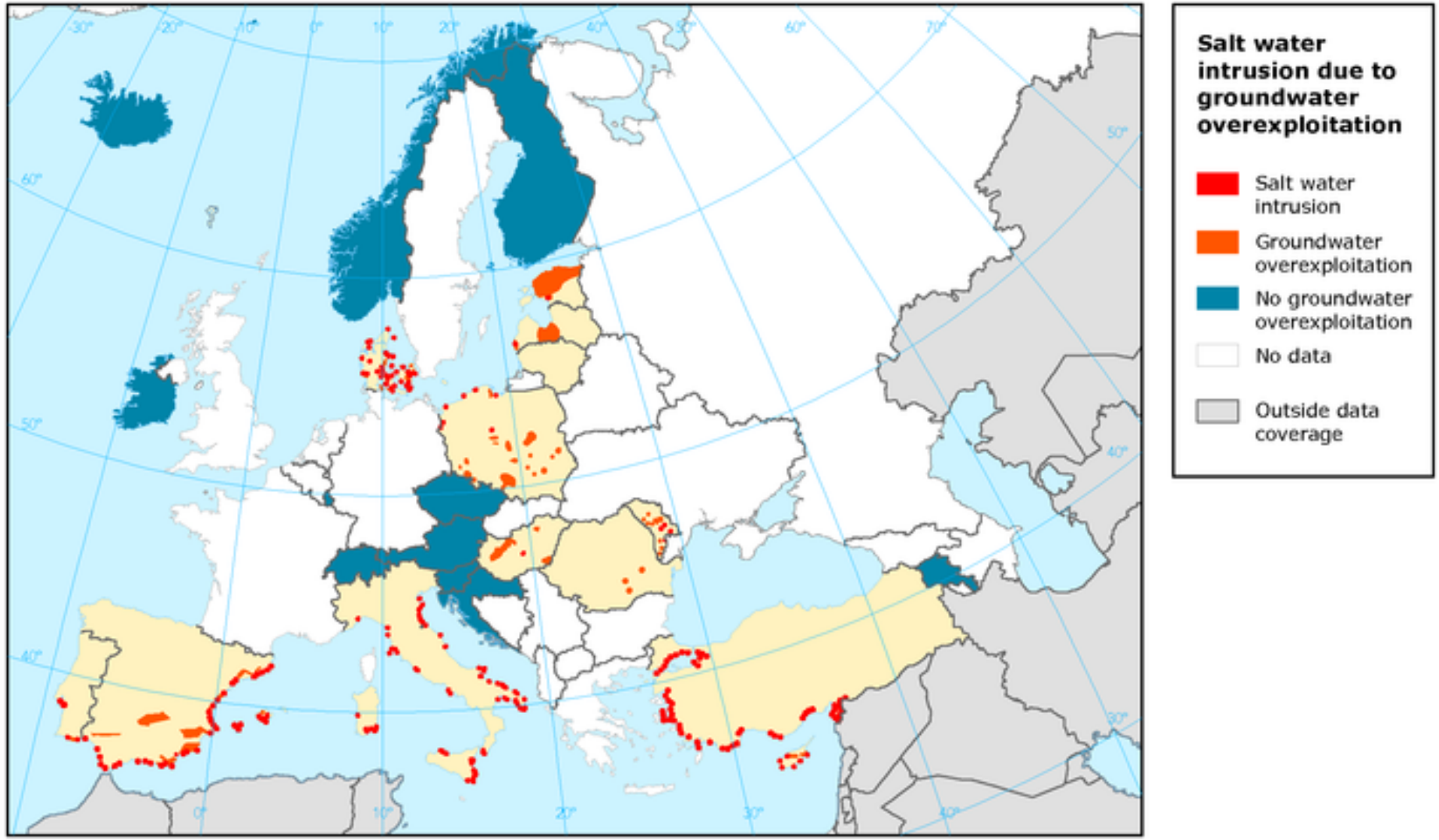
Groundwater over-exploitation occurs when groundwater abstraction exceeds recharge and leads to a lowering of the groundwater table. The rapid expansion in groundwater abstraction over the past 30 to 40 years has supported new agricultural and socioeconomic development in regions where alternative surface water resources are insufficient, uncertain or too costly (EC, 2000). Over-abstraction leads to groundwater depletion, loss of habitats and deteriorating water quality. It is a significant problem in many European countries. One of its impacts is the intrusion of saltwater into aquifers.

In nine of 11 countries where coastal overexploitation was reported to exist, saltwater intrusion is the consequence.

Large areas of the Mediterranean coastline in Italy, Spain and Turkey have been reported to be affected by saltwater intrusion. The main cause is groundwater over-abstraction for public water supply.

Irrigation is the main cause of groundwater over-exploitation in agricultural areas. Some examples are the Greek Argolid plain of the eastern Peloponnesos, where it is common to find boreholes 400 m deep contaminated by saltwater intrusion.

https://www.eea.europa.eu/data-and-maps/indicators/saltwater-intrusion



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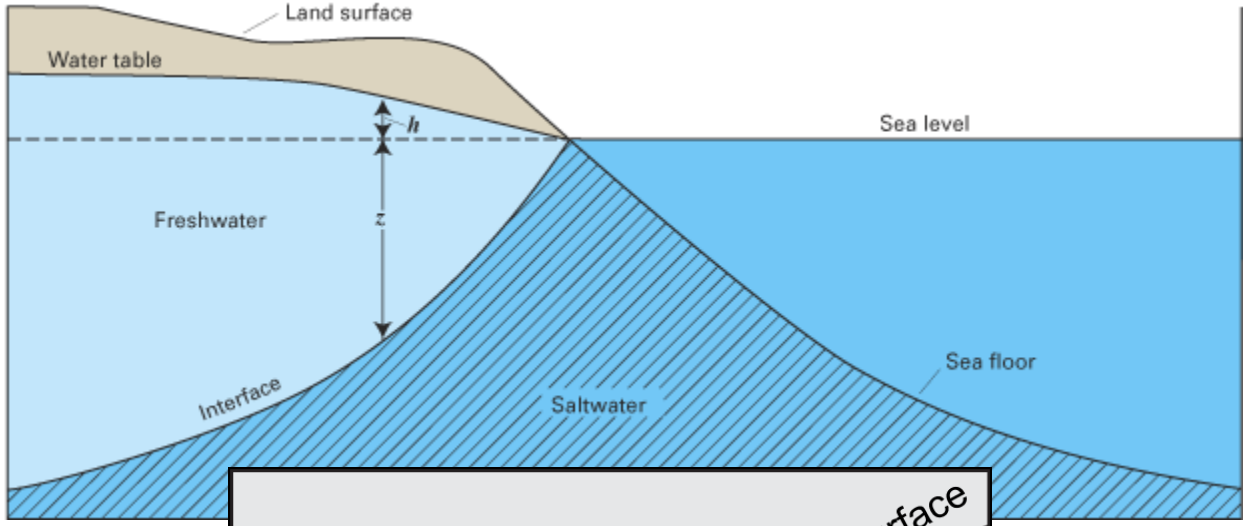
Saltwater intrusion

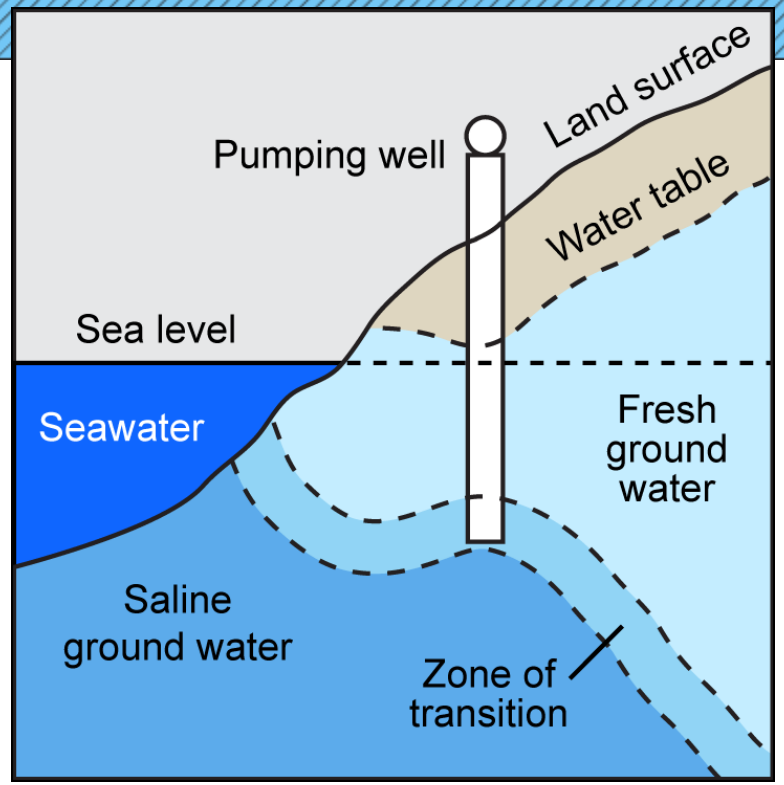
Saltwater intrusion is a major concern commonly found in coastal aquifers around the world.

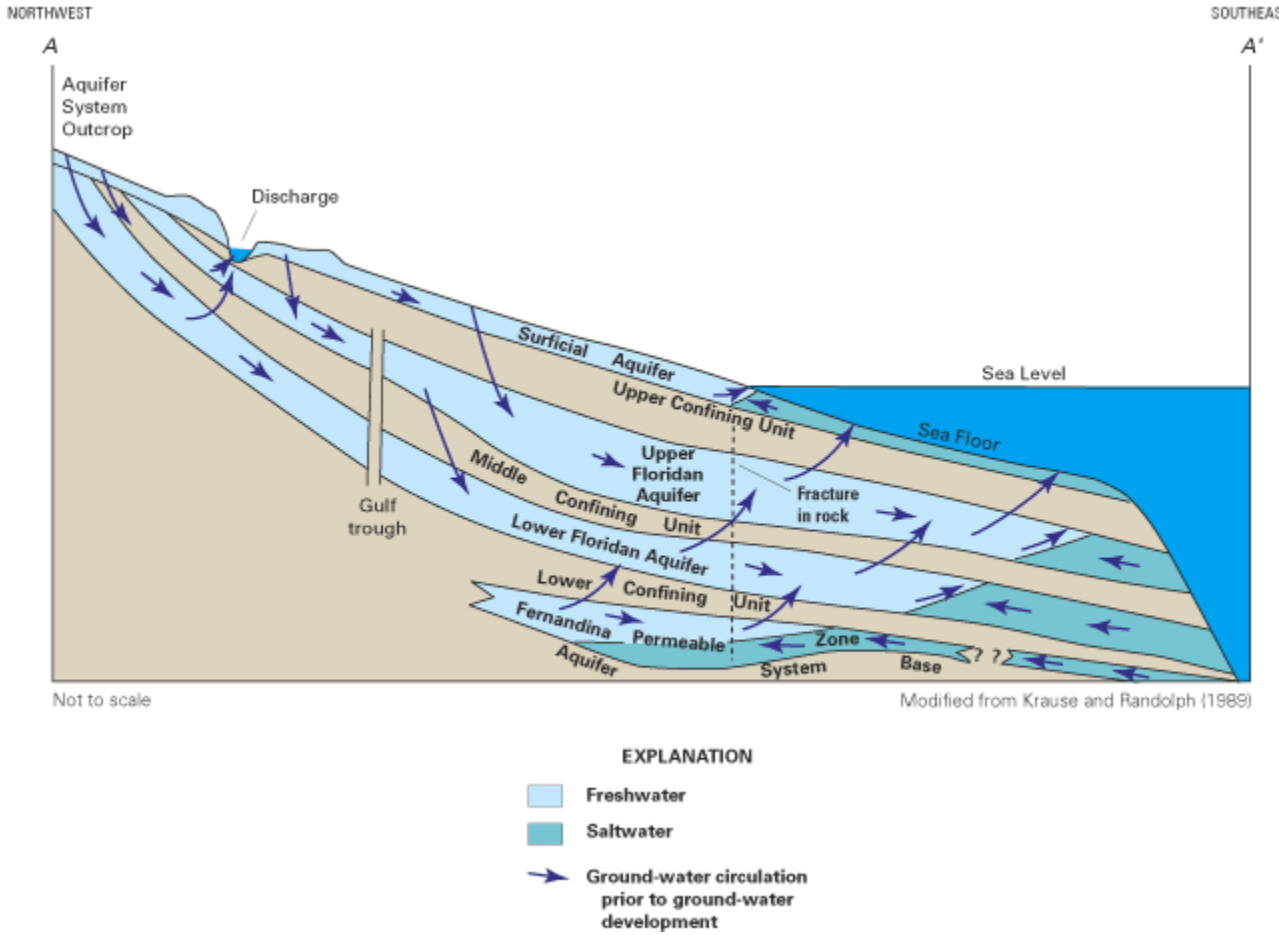
- **Saltwater intrusion** is the movement of saline water into freshwater aquifers.

- Most often, it is caused by ground-water pumping from coastal wells, or from construction of navigation channels or oil field canals.

Salt water intrusion –

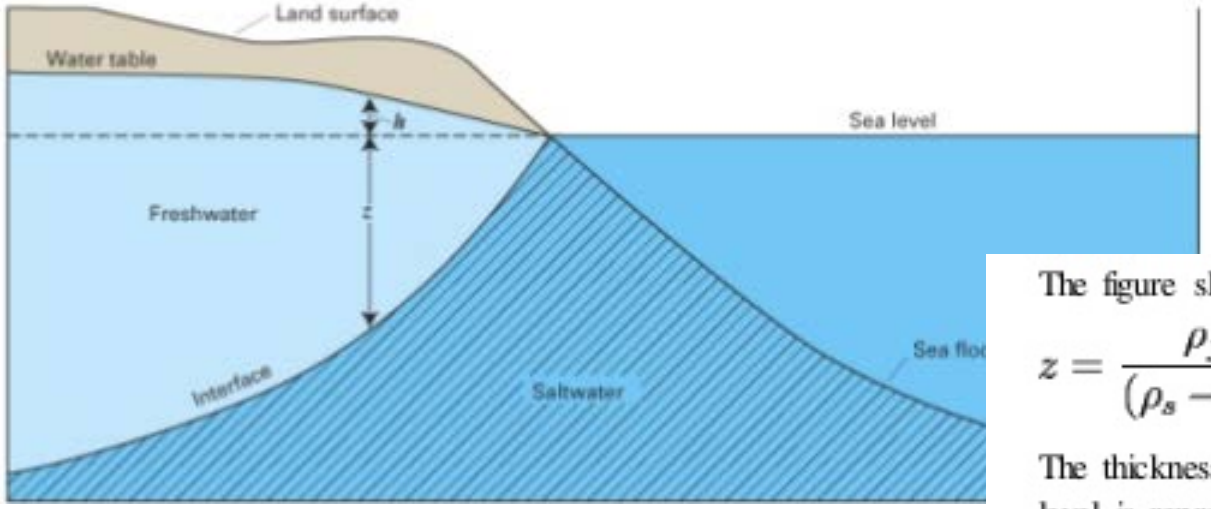






Ghyben-Herzberg Relation:-

The first physical formulations of saltwater intrusion were made by W. Badon-Ghijben (1888, 1889) and A. Herzberg (1901), thus called the Ghyben-Herzberg relation. They derived analytical solutions to approximate the intrusion behavior, which are based on a number of assumptions that do not hold in all field cases.



The figure shows the Ghyben-Herzberg relation. In the equation,

$$z = \frac{\rho_f}{(\rho_s - \rho_f)} h$$

The thickness of the freshwater zone above sea level is represented as h and that below sea level is represented as z. The two thicknesses h and z, are related by ρ_f and ρ_s where ρ_f is the density of freshwater and ρ_s is the density of saltwater. Freshwater has a density of about 1.000 grams per cubic centimetre (g/cm^3) at 20 °C, whereas that of seawater is about 1.025 g/cm^3. The equation can be simplified to

$$z = 40h.$$

The Ghyben-Herzberg ratio states, for every foot of fresh water in an unconfined aquifer above sea level, there will be forty feet of fresh water in the aquifer below sea level.

In the 20th century the higher computing power allowed the use of numerical methods (usually finite differences or finite elements) that need fewer assumptions and can be applied more generally.

Impacts of saltwater intrusion

- **Agricultural production:** Salinity affects production in crops, pastures and trees by interfering with nitrogen uptake, reducing growth and stopping plant reproduction.
- **Water quality:** The most significant off-site impact of dryland salinity is the salinization of previously fresh rivers. This affects the quality of water for drinking and irrigation—with serious economic, social and environmental consequences for both rural and urban communities.
- **Ecological health of streams:** Salt interacts with in-stream biota (animals and plants), changing the ecological health of streams and estuaries. The greatest threat to biodiversity is from the loss of habitat—both on land and in water.
- **Terrestrial biodiversity:** Much of the natural vegetation of salt-affected areas has been destroyed or damaged. This has caused major changes to the landscape and biodiversity including the destruction of remaining natural habitat in many agricultural areas and the fragmentation of many wildlife corridors.
- **Irrigation:** All irrigation water contains some salts, which may remain on the soil surface or on leaves of plants after evaporation. Therefore, any irrigation system has the potential to deliver an increased amount of salt to the soil.